

Energy Statement

12 Canning Crescent

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1 Executive Summary

This report has been produced by Base Energy on behalf of Sleep Design Studio and in support of the planning application for the development named as 12 Canning Crescent comprising the construction of a 4 storey building comprising of 6 flats falling under the requirements of Haringey Council.

It sets out the design approach with regards to energy, carbon dioxide emissions, and sustainability in order to ensure the development complies with:

- National Planning Policy.
- The London Plan.
- The Haringey Local Plan SP4 Working Towards A Low Carbon Haringey.

The above policies require:

- A 25 per cent reduction in CO₂ over Part L 2021 and should aim be zero carbon from 2016.
- A 20 per cent Carbon dioxide reduction from onsite renewable technology.
- A 10 per cent reduction through energy efficiency measures alone.

The design of the development will incorporate energy efficient building fabric and services in addition to low carbon technology:

- Thermal specification meeting and exceeding Part L 2021 minimum/notional U-values.
- A design which limits air permeability, targeting 4.
- A design which limits thermal bridging by targeting the notional Y-value 0.05.
- Energy saving building services including low energy lighting, wastewater heat recovery, heating controls, DMEV fans.

-
- Low carbon Air Source Heat Pumps with a 340% efficiency.
 - Solar PV Panels 1.2kWp per flat totalling 7.2kWp for the total development. This on average would be between 18 to 24 panels displayed horizontally with little or no shading.

This results in a 77% CO2 reduction over Part L1 2021 with 23% of the reduction coming from the incorporation of renewable and low carbon technology. The development also showing a 11% reduction for its fabric efficiency.

3 Planning Policy

National Planning Policy Framework 2021

The NPPF was updated in July 2021 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Local Planning Policy

The relevant Haringey Local Planning Policy requirements are as follows.

The development should target:

- Policy SP4: Working Towards A Low Carbon Haringey.
- In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation, by incorporating the following measures: a. From 2011 onwards, all new residential development will achieve a minimum 25% reduction in total (regulated) CO₂ emissions in line with Code for Sustainable Homes Level 4 energy standards, and should aim to achieve Level 6. All new residential development shall be zero carbon from 2016 onwards.
- The Council will promote low- and zero-carbon energy generation through the following measures:
 - Requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network.
 - Establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible.
 - Working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area
 - All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from onsite renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.

4 Methodology

The Standard Assessment Procedure (SAP) is the UK Government methodology for assessing and calculating the energy performance of dwellings.

The Simplified Building Energy Model (SBEM) is the UK Government methodology for assessing and calculating the energy performance of non-domestic buildings.

SAP and SBEM calculations take into account a range of factors that contribute to energy efficiency, including:

- Materials used for the construction and the thermal insulation of the building fabric (u-values¹ and thermal mass)
- Air permeability
- Efficiency, fuel source, and control of heating and cooling systems
- Ventilation system energy use and heat recovery
- Lighting energy
- Low carbon and energy saving or generating technologies

Approved Document Part L of current Building Regulations addresses the conservation of fuel and power. Part L is divided into two separate documents:

- Part L1 Newly constructed and extended or renovated existing dwellings
- Part L2 Newly constructed and extended or renovated existing non-domestic buildings

To comply with Part L, the calculations should demonstrate how the building will either meet or achieve a percentage reduction in the Building Emission Rate (BER) under the required Target Emission Rate (TER).

The calculation software has been used to calculate a baseline of energy demand and carbon dioxide emissions as appropriate from which any reductions or contributions have been measured.

¹ U-values (Thermal Transmittance) - the measure of the overall rate of heat transfer by all mechanisms under standard conditions, through a particular section of a construction. Lower u-values mean better thermal insulation

5 Baseline Energy & CO2

SAP 10 Energy modelling software has been used to calculate a baseline for the development. This forms the basis from which compliance with planning policy has been measured.

Table 5.1: Baseline CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	82.63	402.69	33,274

The **Total Baseline CO2 Emissions** for the development are shown to be 33,274 kg/year.

Table 5.2: Baseline Fabric Energy Demand

	Energy Demand (kWh/m2/year)	Floor Area (m2)	Total Baseline Energy Demand (kWh/year)
Baseline	255.80	402.69	103,008

The **Baseline Energy Demand** for the development is shown to be 103,008 kWh per year.

6 Low Carbon Design – Fabric First – Be Lean

Before considering low carbon energy generating technology the development has been designed to reduce energy demand through the first step of the energy hierarchy by considering 'fabric first'. A thermally efficient building envelope will follow the design standards as set out below.

Table 6.0: Building Fabric Standards (including u-values W/m²K)

	Part L 2013 Limiting Parameters	Part L 2021 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development
Walls	0.30	0.26	0.18	0.18
Ground Floor	0.25	0.18	0.13	0.11
Roof	0.20	0.16	0.11	0.11
Windows	2.00	1.6	1.2	1.2
Doors	2.00	1.6	1.0	1.4
Air permeability	10.00	8.00	5.00	4.00

- Insulation: The specified building envelope is designed to meet and exceed the notional Part L targets and will help to limit the energy demand of the dwelling for space heating
- Thermal bridging: The design will seek to limit heat loss through thermal bridging targeting a global 'y-value' of 0.05.

Once heat retention has been addressed the next step is to ensure energy consuming building services are efficient.

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt.
- Space & Water Heating: Air Source Heat Pump.
- Heating Controls: Comprising programmer and thermostat.
- Ventilation: DMEV fans assumed Vent Axia Lo- Carbon NBR C100 with and SFP 0.08.
- Wastewater heat recovery systems in the form of Recoup Easyfit+ System A, with a utilisation factor 0.972.

The specifications outlined above, and with the heating provided by a gas system as required by the GLA guidance, have been incorporated into the calculation to generate a dwelling emission rate to be measured against the baseline data.

Table 6.1: Baseline vs Be Lean CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	82.63	402.69	33,274	N/A
Be Lean	37.77	402.69	15,210	54%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 11,553 kg/year.

Table 6.2: Baseline vs Be Lean Fabric Energy Demand

	Energy Demand (kWh/m2/year)	Floor Area (m2)	Total Baseline Energy Demand (kWh/year)	Reduction in Energy Demand
Baseline	255.80	402.69	103,008	N/A
Be Lean	220.64	402.69	88,849	11%

The **Be Lean Energy Demand reduction** as a result of energy efficient fabric and services is shown to be 88,849 kWh per year

7 Low Carbon Technology Review & Recommendations

Having set out an energy efficient design, the next step is to incorporate low carbon technology for energy generation. A number of technologies exist and should be specified where they:

- compliance with planning policy
- are feasible for the site
- are cost efficient
- are appropriate for proposed development form and function
- protect against fuel poverty
- promote fuel security
- reduce reliance on fossil fuels
- reduce carbon emissions
- reduce resource depletion
- reduce pollution

Site location and development form and function will influence the suitability of different technologies through:

- Orientation
- Space (inside and outside of the buildings)
- Surrounding topography, structures, and natural features
- Wind speed
- Overshading
- Geology and ground conditions
- Building form, function, and density

In determining the most feasible renewable technologies for the dwelling, the following have been reviewed:

- Wind turbines
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Biomass
- Combined Heat and Power
- Photovoltaic Panels
- Solar water heating

WIND TURBINES

Wind turbines are used to produce electricity. They can be either pole mounted (in a suitably exposed position) or building mounted; building mounted systems need a sufficient wind speed at the structural height and both a structural survey and planning permission.

- Wind speed can be too low on low rise buildings
- Taller systems need sufficient space
- Wind resources very variable and unpredictable
- May need planning permission

Wind turbines technology is **not recommended** for this development

GROUND SOURCE HEAT PUMP (GSHP)

GSHPs use naturally occurring underground low-level heat in areas with appropriate geological features. Heat is transferred from the ground by either extracting and discharging (re-charging) water from/to the ground directly (open loop) or circulating water through pipes buried within the ground, (closed loop). The water is passed through a heat pump to transfer the heat from this water into a higher temperature water circuit to provide heating. The loop can be fitted horizontally (laid in a shallow trench) or vertically (in a borehole).

- Feasibility analysis is costly
- Suitable ground conditions required
- More capital intensive than air source heat pumps
- Can be more efficient and lower running costs than ASHPs
- Well suited to highly insulated buildings

Ground source heat pump technology is **not recommended** for this development

AIR SOURCE HEAT PUMP (ASHP)

ASHP systems absorb heat from outside air at a low temperature into a fluid which is then passed through an electrically driven compressor where its temperature is increased. There are two main types of ASHP systems: Air to Water systems distribute heat through wet central heating; Air to air produce warm air which is circulated by fans. For an ASHP system to be installed, there needs to be ample outdoor space for the external condensing unit; these units can also be noisy and blow out colder air to the neighbouring environment.

- Requires space for external plant and internal hot water tank for wet systems supplying DHW
- Can generate noise though quieter systems have been developed
- Least efficient when most needed
- Longer life than fossil fuel boilers
- High capital costs vs gas systems but lower than GSHPs
- Well suited to highly insulated buildings

Air source heat pump technology **is recommended** for this development

BIOMASS

Biomass systems burn wood pellets, chips, or logs to provide heat in a single room, or to power central heating and hot water boilers. There needs to be ample space available for both the boiler and the storage of fuel. There will also be regular deliveries of fuel and therefore adequate site access is required.

- Carbon emissions are cyclical unlike fossil fuel
- Requires fuel storage space and bulk delivery
- Carbon 'neutral' fuel in isolation but supply side emissions are still present so not neutral overall
- Harmful particulate emissions impact air quality and health

Biomass technology **is not recommended** for this development

COMBINED HEAT AND POWER (CHP)

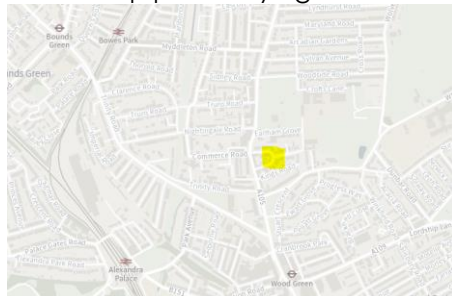
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating engine or turbine, which in turn drives an alternator to generate electrical power. The heat emitted by the engine and exhaust gases is recovered and used to heat the building or to provide hot water.

- Reduces consumption of and reliance on grid electricity
- Works best with high and consistent heat and hot water demand
- Recovers waste energy
- Can export to the grid
- Uses fossil fuel
- Emissions on site rather than upstream
- Efficiency is sensitive to sizing

CHP **is not recommended** for this development

DISTRICT HEATING

District Heating systems provide multiple buildings or dwellings with heat and hot water from a central boiler house, or 'energy centre'. The system can provide heating or cooling which is transferred from the energy centre through a network of highly insulated pipes carrying the heated water to each dwelling.



- Economies of scale
- Frees up space in habitable areas of development
- Variety of systems
- Can make use of waste heat from industry
- Can be fossil fuel based and dependent

With reference to the Local Heat Map it has been determined that there are no existing heat networks or energy centres within a suitable radius from the development and there are no existing networks local to the site

District heating **is not recommended** for this development

SOLAR PHOTOVOLTAIC (PV)

Solar PV cells (which are mounted together in panels or tiles on the roof) convert sunlight into electricity. The cells are made from layers of semi-conducting material; when the light shines on the cell, an electric field is created across the layers. Although PV cells are most effective in bright sunlight, they can still generate electricity on a cloudy day. The power of a PV cell is measured in kilowatts peak (kWp). Each PV panel produces 0.25Watts to 0.35Watts depending on the manufacture.

- Passive technology, requires no energy input from grid
- Does not require sunny days to generate power
- Capital costs can be high although payback is effective
- Needs sufficient roof space and orientation
- Zero site or upstream emissions
- Can export to the grid

Solar PV technology **is recommended** for this development

SOLAR HOT WATER

Solar hot water systems absorb energy from the sun and transfer this energy using heat exchangers to heat water which can then be stored. Systems should be roof mounted and oriented to face between a south-east and south-west direction.

- Mostly passive technology but requires pump energy
- Not suitable for combi boilers and developments without roof space
- Lower CO2 reductions than other technologies

Solar hot water technology **is not recommended** for this development

Low Carbon Technology Summary

The low carbon technology review indicates that ASHP with Solar PV would be potentially feasible. The following low carbon technology is recommended:

ASHP and Solar PV

This technology is deemed optimal for meeting the needs of the development and achieving policy compliance. It has been incorporated into the energy model and the results are presented in the next section.

8 Low Carbon Technology – Renewable Energy Generation - Be Green

The selected Low Carbon Technology has been incorporated into the calculation and the results are set out below.

Table 8.1: Baseline vs Be Lean CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	82.63	402.69	33,274	N/A
Be Lean	37.77	402.69	15,210	54%
Lean & Green Design	17.95	402.69	7,228	77%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 7,228 kg/year.

9 Conclusion

Proposals are for the development named as 12 Canning Crescent comprising the construction of a 4 storey building consisting of 6 flats falling under the requirements of Haringey District Council.

- Under the local planning policy the proposed development is required to a 25 per cent reduction in CO₂ over Part L 2021 and should be zero carbon from 2016.
- A 20 per cent Carbon dioxide reduction from onsite renewable technology
- A 10 per cent reduction through energy efficiency measures alone

Energy modelling software has been used to calculate a baseline against which compliance with the above can be measured.

The proposed development will be designed to limit energy demand through the inclusion of a thermally efficient building fabric and energy efficient services.

Low carbon technology will be incorporated and is to comprise ASHP's and solar PV.

This results in a 77% CO₂ reduction over Part L1 2021 with a 23% of the reduction coming from the incorporation of renewable and low carbon technology. The development also showing a 11% reduction for its fabric efficiency for the Be Lean assessment.

This Energy Statement and the calculations on which it is based demonstrate that the proposed development complies with the local planning policy requirements.

10 Appendix 1 – Be Lean SAP worksheets

Full SAP Calculation Printout



Property Reference	S10992 01				Issued on Date	17/05/2023
Assessment Reference	Be Lean		Prop Type Ref			
Property						
SAP Rating	72 C	DER	6.61	TER	14.60	
Environmental	94 A	% DER < TER				54.73
CO ₂ Emissions (t/year)	0.54	DFEE	45.75	TFEE	47.32	
Compliance Check	See BREL	% DFEE < TFEE				3.32
% DPER < TPER	10.66	DPER	69.06	TPER	77.30	
Assessor Details	Mr. Peter Kinsella				Assessor ID	L770-0002
Client						

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.8200 (1b)	x 2.5000 (2b)	= 227.0500 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.8200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.0500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

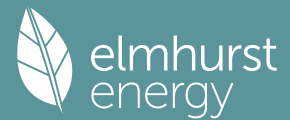
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Corridor door			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.20)			23.4000	1.1450	26.7939		(27)
Heat Loss Floor 1			90.8200	0.1100	9.9902	110.0000	9990.2000 (28a)
External Wall 1	86.2950	23.4000	62.8950	0.1800	11.3211	18.0000	1132.1100 (29a)

Full SAP Calculation Printout



Corridor wall	42.3800	1.8900	40.4900	0.1800	7.2882	9.0000	364.4100 (29a)
Bike area wall	30.1000		30.1000	0.1800	5.4180	9.0000	270.9000 (29a)
Total net area of external elements Aum(A, m2)			249.5950				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	63.4574			(33)
Party Ceilings 1			90.8200			20.0000	1816.4000 (32b)

Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13574.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							149.4607 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							12.4798 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	75.9371 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	(38)
	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	(39)
Average = Sum(39)m / 12 =												113.4004	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6368 (42)
Hot water usage for mixer showers													
	94.0911	92.6771	90.6166	86.6742	83.7648	80.5204	78.6762	80.7211	82.9626	86.4463	90.4733	93.7306	(42a)
Hot water usage for baths													
	29.5503	29.1114	28.4934	27.3539	26.5007	25.5546	25.0435	25.6572	26.3254	27.3378	28.5008	29.4504	(42b)
Hot water usage for other uses													
	41.6333	40.1193	38.6054	37.0914	35.5775	34.0636	34.0636	35.5775	37.0914	38.6054	40.1193	41.6333	(42c)
Average daily hot water use (litres/day)												151.9950	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	165.2746	161.9078	157.7154	151.1196	145.8430	140.1385	137.7833	141.9558	146.3795	152.3894	159.0934	164.8142	(44)
Energy conte	261.7546	230.5546	242.4027	206.8752	196.3328	172.3166	166.6369	175.7709	180.5006	206.7910	226.6577	258.0592	(45)
Energy content (annual)										Total = Sum(45)m =		2524.6527	
Distribution loss (46)m = 0.15 x (45)m													
	39.2632	34.5832	36.3604	31.0313	29.4499	25.8475	24.9955	26.3656	27.0751	31.0186	33.9986	38.7089	(46)

Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0206	(55)
Total storage loss													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)

If cylinder contains dedicated solar storage													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	316.6556	280.1426	297.3037	260.0052	251.2338	225.4466	221.5379	230.6719	233.6306	261.6920	279.7877	312.9602	(62)
WWHRS	-51.6701	-45.6974	-47.8517	-39.6231	-36.9273	-31.5990	-29.6190	-31.4968	-32.6935	-38.5421	-43.6635	-50.7132	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	264.9855	234.4451	249.4519	220.3820	214.3064	193.8476	191.9189	199.1751	200.9370	223.1499	236.1242	262.2470	(64)
Total per year (kWh/year) = Sum(64)m =												2690.9709	(64)
												2691	(64)

12Total per year (kWh/year)													
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	130.9542	116.3298	124.5197	111.2900	109.2014	99.7993	99.3276	102.3646	102.5204	112.6788	117.8677	129.7255	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9a), also see Table 5	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	(66)
	121.3441	134.3453	121.3441	125.3889	121.3441	125.3889	121.3441	121.3441	125.3889	121.3441	125.3889	121.3441	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	240.5783	243.0747	236.7837	223.3910	206.4851	190.5959	179.9809	177.4845	183.7755	197.1682	214.0741	229.9633	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	(69)
Pumps, fans	13.6230	13.6230	13.6230	13.6230	13.6230	0.0000	0.0000	0.0000	0.0000	13.6230	13.6230	13.6230	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	(71)
Water heating gains (Table 5)													
	176.0137	173.1098	167.3652	154.5694	146.7761	138.6101	133.5048	137.5869	142.3895	151.4500	163.7051	174.3622	(72)
Total internal gains													
	614.1108	626.7045	601.6677	579.5240	550.7800	517.1466	497.3815	498.9671	514.1055	546.1370	579.3428	601.8443	(73)

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6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			10.5300	10.6334	0.6300	0.7000	0.7700	34.2194 (74)				
South			4.2900	46.7521	0.6300	0.7000	0.7700	61.2957 (78)				
West			8.5800	19.6403	0.6300	0.7000	0.7700	51.4999 (80)				
Solar gains	147.0150	266.5262	404.9089	564.9897	687.5953	705.9071	670.9391	576.4412	460.1477	305.6626	179.0846	123.8431 (83)
Total gains	761.1257	893.2307	1006.5766	1144.5137	1238.3753	1223.0537	1168.3207	1075.4084	974.2532	851.7996	758.4274	725.6874 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr		Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	
alpha	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	
util living area	0.9674	0.9461	0.9084	0.8269	0.6984	0.5428	0.4108	0.4595	0.6737	0.8693	0.9483	0.9718 (86)	
MIT	19.4407	19.6643	19.9814	20.3660	20.6645	20.8261	20.8803	20.8696	20.7449	20.3494	19.8206	19.3870 (87)	
Th 2	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757 (88)	
util rest of house	0.9640	0.9406	0.8990	0.8093	0.6690	0.4996	0.3571	0.4040	0.6328	0.8520	0.9421	0.9688 (89)	
MIT 2	18.9027	19.1233	19.4347	19.8058	20.0837	20.2245	20.2663	20.2593	20.1598	19.7960	19.2799	18.8495 (90)	
Living area fraction	fLA = Living area / (4) =												0.3206 (91)
MIT	19.0752	19.2968	19.6100	19.9854	20.2699	20.4174	20.4632	20.4550	20.3474	19.9735	19.4533	19.0218 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.0752	19.2968	19.6100	19.9854	20.2699	20.4174	20.4632	20.4550	20.3474	19.9735	19.4533	19.0218 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9553	0.9294	0.8858	0.7973	0.6638	0.5025	0.3648	0.4112	0.6308	0.8395	0.9311	0.9607 (94)
Useful gains	727.0857	830.1331	891.6693	912.5328	821.9820	614.6435	426.2239	442.2323	614.5962	715.0568	706.1726	697.1955 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1675.5121	1632.6021	1486.6752	1257.0874	971.8282	659.6935	438.0856	459.8406	708.4537	1062.9543	1400.8646	1680.8018 (97)
Space heating kWh	705.6293	539.2592	442.6844	248.0793	111.4856	0.0000	0.0000	0.0000	0.0000	258.8357	500.1782	731.8031 (98a)
Space heating requirement - total per year (kWh/year)												3537.9548
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	705.6293	539.2592	442.6844	248.0793	111.4856	0.0000	0.0000	0.0000	0.0000	258.8357	500.1782	731.8031 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3537.9548
Space heating per m2										(98c) / (4) =		38.9557 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												170.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	705.6293	539.2592	442.6844	248.0793	111.4856	0.0000	0.0000	0.0000	0.0000	258.8357	500.1782	731.8031 (98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000 (210)
Space heating fuel (main heating system)	415.0760	317.2113	260.4026	145.9290	65.5798	0.0000	0.0000	0.0000	0.0000	152.2563	294.2225	430.4724 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	264.9855	234.4451	249.4519	220.3820	214.3064	193.8476	191.9189	199.1751	200.9370	223.1499	236.1242	262.2470 (64)
Efficiency of water heater												170.0000 (216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000 (217)
Fuel for water heating, kWh/month												

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	155.8738	137.9089	146.7364	129.6365	126.0626	114.0280	112.8935	117.1618	118.1983	131.2647	138.8966	154.2630	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	13.7346	12.4055	13.7346	13.2916	13.7346	13.2916	13.7346	13.7346	13.2916	13.7346	13.2916	13.7346	(231)
Lighting	27.7492	22.2615	20.0440	14.6851	11.3432	9.2675	10.3476	13.4502	17.4705	22.9223	25.8907	28.5205	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2081.1499	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												170.0000	
Water heating fuel used												1582.9241	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 2.6680, total flow = 29.0000, SFP = 0.0920)													
mechanical ventilation fans (SFP = 0.0920)												25.4841	(230a)
warm air heating system fans												136.2300	(230b)
Total electricity for the above, kWh/year												161.7141	(231)
Electricity for lighting (calculated in Appendix L)												223.9523	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4049.7403	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2081.1499	0.1552	323.0786	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1582.9241	0.1408	222.8289	(264)
Space and water heating			545.9075	(265)
Pumps, fans and electric keep-hot	161.7141	0.1387	22.4317	(267)
Energy for lighting	223.9523	0.1443	32.3232	(268)
Total CO2, kg/year			600.6625	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.6100	(273)

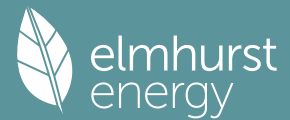
13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2081.1499	1.5747	3277.2390	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1582.9241	1.5205	2406.8543	(278)
Space and water heating			5684.0933	(279)
Pumps, fans and electric keep-hot	161.7141	1.5128	244.6411	(281)
Energy for lighting	223.9523	1.5338	343.5055	(282)
Total Primary energy kWh/year			6272.2398	(286)
Dwelling Primary energy Rate (DPER)			69.0600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

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Ground floor	Area (m2)	Storey height (m)	Volume (m3)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.8200 (1b)	x 2.5000 (2b)	= 227.0500 (1b) - (4)
Dwelling volume	(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		227.0500 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1321 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000 (17)		
Infiltration rate	0.3821 (18)		
Number of sides sheltered	1 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3535 (21)	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)	
Adj infilt rate	0.4507	0.4418	0.4330	0.3888	0.3800	0.3358	0.3358	0.3270	0.3535	0.3800	0.3977	0.4153 (22b)	
Effective ac	0.6016	0.5976	0.5937	0.5756	0.5722	0.5564	0.5564	0.5535	0.5625	0.5722	0.5791	0.5862 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			20.8200	1.1450	23.8397			(27)
Heat Loss Floor 1			90.8200	0.1300	11.8066			(28a)
External Wall 1	86.2950	20.8200	65.4750	0.1800	11.7855			(29a)
Corridor wall	42.3800	1.8900	40.4900	0.1800	7.2882			(29a)
Bike area wall	30.1000		30.1000	0.1800	5.4180			(29a)
Total net area of external elements Aum(A, m2)			249.5950					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.0280			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								159.4607 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)				12.9000	0.0500	0.6450		
E3 Sill				12.0000	0.0500	0.6000		
E4 Jamb				27.6000	0.0500	1.3800		
E5 Ground floor (normal)				63.5100	0.1600	10.1616		
E16 Corner (normal)				10.0000	0.0900	0.9000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								13.6866 (36)
Point Thermal bridges						(36a) =		0.0000
Total fabric heat loss						(33) + (36) + (36a) =		75.7146 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	45.0723	44.7768	44.4872	43.1269	42.8724	41.6876	41.6876	41.4682	42.1439	42.8724	43.3873	43.9255 (38)	
Average = Sum(39)m / 12 =	120.7869	120.4914	120.2018	118.8415	118.5870	117.4022	117.4022	117.1828	117.8585	118.5870	119.1018	119.6401 (39)	
	118.8403												
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.3300	1.3267	1.3235	1.3085	1.3057	1.2927	1.2927	1.2903	1.2977	1.3057	1.3114	1.3173 (40)	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6368 (42)
Hot water usage for mixer showers	68.4299	67.4015	65.9030	63.0358	60.9199	58.5603	57.2190	58.7062	60.3365	62.8700	65.7988	68.1677 (42a)	
Hot water usage for baths	29.5503	29.1114	28.4934	27.3539	26.5007	25.5546	25.0435	25.6572	26.3254	27.3378	28.5008	29.4504 (42b)	

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Hot water usage for other uses												
Average daily hot water use (litres/day)	41.6333	40.1193	38.6054	37.0914	35.5775	34.0636	34.0636	35.5775	37.0914	38.6054	40.1193	41.6333 (42c)
												128.3362 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	139.6134	136.6323	133.0018	127.4812	122.9981	118.1784	116.3261	119.9409	123.7533	128.8132	134.4188	139.2513 (44)
Energy content (annual)	221.1135	194.5625	204.4188	174.5153	165.5791	145.3141	140.6864	148.5119	152.6002	174.7982	191.5043	218.0340 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2131.6383
Water storage loss:	33.1670	29.1844	30.6628	26.1773	24.8369	21.7971	21.1030	22.2768	22.8900	26.2197	28.7256	32.7051 (46)
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	267.7084	236.6482	251.0137	219.6072	212.1740	190.4060	187.2813	195.1069	197.6921	221.3931	236.5961	264.6289 (62)
WWHRS	-31.2833	-27.6672	-28.9715	-23.9895	-22.3574	-19.1314	-17.9326	-19.0695	-19.7941	-23.3350	-26.4357	-30.7040 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	236.4252	208.9810	222.0422	195.6176	189.8166	171.2746	169.3487	176.0373	177.8980	198.0581	210.1604	233.9249 (64)
												Total per year (kWh/year) = Sum(64)m = 2389.5846 (64)
12Total per year (kWh/year)												2390 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	110.7962	98.3606	105.2452	94.0998	92.3310	84.3904	84.0541	86.6561	86.8130	95.3963	99.7486	109.7722 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	121.3441	134.3453	121.3441	125.3889	121.3441	125.3889	121.3441	121.3441	125.3889	121.3441	125.3889	121.3441 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	240.5783	243.0747	236.7837	223.3910	206.4851	190.5959	179.9809	177.4845	183.7755	197.1682	214.0741	229.9633 (68)
Pumps, fans	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711 (71)
Total internal gains	148.9196	146.3700	141.4586	130.6942	124.1007	117.2089	112.9760	116.4733	120.5737	128.2209	138.5398	147.5433 (72)
	576.3936	589.3416	565.1381	545.0258	517.4816	495.7454	476.8527	477.8536	492.2897	512.2849	543.5545	564.4024 (73)

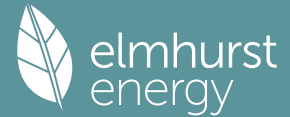
6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			9.3600	10.6334	0.6300	0.7000	0.7700	30.4172 (74)				
South			3.8200	46.7521	0.6300	0.7000	0.7700	54.5803 (78)				
West			7.6400	19.6403	0.6300	0.7000	0.7700	45.8577 (80)				
Solar gains	130.8553	237.2248	360.3756	502.8137	611.8907	628.1700	597.0595	512.9917	409.5276	272.0541	159.3990	110.2309 (83)
Total gains	707.2489	826.5664	925.5136	1047.8395	1129.3723	1123.9153	1073.9123	990.8453	901.8173	784.3390	702.9535	674.6332 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	33.3053	33.3869	33.4674	33.8505	33.9231	34.2655	34.2655	34.3296	34.1328	33.9231	33.7765	33.6245
util living area	3.2204	3.2258	3.2312	3.2567	3.2615	3.2844	3.2844	3.2886	3.2755	3.2615	3.2518	3.2416
	0.9775	0.9624	0.9349	0.8692	0.7562	0.5967	0.4574	0.5079	0.7251	0.9027	0.9635	0.9805 (86)
MIT	18.9037	19.1890	19.6100	20.1620	20.6042	20.8711	20.9596	20.9428	20.7460	20.1645	19.4463	18.8612 (87)
Th 2	19.8174	19.8200	19.8225	19.8342	19.8363	19.8466	19.8466	19.8485	19.8426	19.8363	19.8319	19.8273 (88)
util rest of house	0.9726	0.9542	0.9204	0.8399	0.7020	0.5109	0.3472	0.3949	0.6470	0.8741	0.9542	0.9762 (89)

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MIT 2	17.4102	17.7711	18.2993	18.9787	19.4851	19.7610	19.8296	19.8222	19.6518	19.0002	18.1084	17.3625 (90)
Living area fraction									fLA = Living area / (4) =			0.3206 (91)
MIT	17.8890	18.2257	18.7195	19.3582	19.8439	20.1169	20.1919	20.1815	20.0027	19.3735	18.5373	17.8430 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8890	18.2257	18.7195	19.3582	19.8439	20.1169	20.1919	20.1815	20.0027	19.3735	18.5373	17.8430 (93)

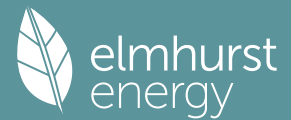
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9611	0.9394	0.9031	0.8257	0.7024	0.5322	0.3814	0.4291	0.6590	0.8601	0.9401	0.9657	(94)
Useful gains	679.7122	776.4399	835.8351	865.2266	793.2230	598.1193	409.5899	425.1908	594.2896	674.6019	660.8482	651.5151	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000		(96)
Heat loss rate W	1641.3765	1605.6365	1468.8106	1242.8625	965.7632	647.7002	421.6977	443.1288	695.6786	1040.4199	1362.2093	1632.2541	(97)
Space heating kWh	715.4782	557.2201	470.9338	271.8979	128.3699	0.0000	0.0000	0.0000	0.0000	272.1686	504.9800	729.6699	(98a)
Space heating requirement - total per year (kWh/year)												3650.7183	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	715.4782	557.2201	470.9338	271.8979	128.3699	0.0000	0.0000	0.0000	0.0000	272.1686	504.9800	729.6699	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3650.7183	
Space heating per m2											(98c) / (4) =	40.1973	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	715.4782	557.2201	470.9338	271.8979	128.3699	0.0000	0.0000	0.0000	0.0000	272.1686	504.9800	729.6699	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	775.1660	603.7054	510.2208	294.5806	139.0790	0.0000	0.0000	0.0000	0.0000	294.8738	547.1073	790.5416	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	236.4252	208.9810	222.0422	195.6176	189.8166	171.2746	169.3487	176.0373	177.8980	198.0581	210.1604	233.9249	(64)
Efficiency of water heater	86.3803	86.1499	85.7029	84.7984	83.2021	79.8000	79.8000	79.8000	79.8000	84.7730	85.9513	86.4335	(216)
Fuel for water heating, kWh/month	273.7025	242.5783	259.0836	230.6857	228.1392	214.6298	212.2164	220.5981	222.9298	233.6335	244.5111	270.6414	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.2129	20.2267	18.2119	13.3428	10.3064	8.4204	9.4018	12.2209	15.8737	20.8271	23.5242	25.9137	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-24.0405	-35.4610	-53.2988	-62.7442	-70.1088	-66.3163	-65.4862	-60.5956	-52.4127	-41.7636	-26.9743	-20.6041	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-9.2041	-19.7359	-39.9368	-61.0441	-81.7728	-82.5679	-81.6170	-68.6363	-49.6822	-28.5918	-12.4042	-7.2522	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												3955.2744	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.8000	
Water heating fuel used												2853.3495	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												203.4826	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-1122.2515	(233)

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Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	5975.8550 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3955.2744	0.2100	830.6076 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2853.3495	0.2100	599.2034 (264)
Space and water heating			1429.8110 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	203.4826	0.1443	29.3688 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-579.8062	0.1337	-77.4933
PV Unit electricity exported	-542.4453	0.1254	-68.0110
Total			-145.5043 (269)
Total CO2, kg/year			1325.6048 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.6000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3955.2744	1.1300	4469.4601 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2853.3495	1.1300	3224.2850 (278)
Space and water heating			7693.7450 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	203.4826	1.5338	312.1084 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-579.8062	1.4939	-866.1777
PV Unit electricity exported	-542.4453	0.4602	-249.6336
Total			-1115.8112 (283)
Total Primary energy kWh/year			7020.1430 (286)
Target Primary Energy Rate (TPER)			77.3000 (287)

11 Appendix 2 – Be Green SAP worksheets

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Property Reference	S10992 01	Issued on Date	17/05/2023
Assessment Reference	Be Green	Prop Type Ref	
Property			
SAP Rating	84 B	DER	3.54
Environmental	97 A	TER	14.60
CO ₂ Emissions (t/year)	0.28	% DER < TER	75.75
Compliance Check	See BREL	DFEE	45.75
% DPER < TPER	48.61	TFEE	47.32
		% DFEE < TFEE	3.32
		TPER	77.30
Assessor Details	Mr. Peter Kinsella	Assessor ID	L770-0002
Client			

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.8200 (1b)	x 2.5000 (2b)	= 227.0500 (1b) - (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.8200		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.0500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	1 (19)

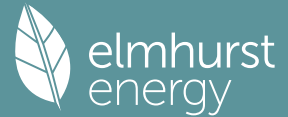
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Corridor door			1.8900	1.4000	2.6460		(26)
Windows (Uw = 1.20)			23.4000	1.1450	26.7939		(27)
Heat Loss Floor 1			90.8200	0.1100	9.9902	110.0000	9990.2000 (28a)
External Wall 1	86.2950	23.4000	62.8950	0.1800	11.3211	18.0000	1132.1100 (29a)

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Corridor wall	42.3800	1.8900	40.4900	0.1800	7.2882	9.0000	364.4100 (29a)
Bike area wall	30.1000		30.1000	0.1800	5.4180	9.0000	270.9000 (29a)
Total net area of external elements Aum(A, m2)			249.5950				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	63.4574			(33)
Party Ceilings 1			90.8200			20.0000	1816.4000 (32b)

Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13574.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							149.4607 (35)
Thermal bridges (User defined value 0.050 * total exposed area)							12.4798 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	75.9371 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	37.4633	(38)
	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	113.4004	(39)
Average = Sum(39)m / 12 =												113.4004	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	1.2486	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.6368 (42)
Hot water usage for mixer showers													
	94.0911	92.6771	90.6166	86.6742	83.7648	80.5204	78.6762	80.7211	82.9626	86.4463	90.4733	93.7306	(42a)
Hot water usage for baths													
	29.5503	29.1114	28.4934	27.3539	26.5007	25.5546	25.0435	25.6572	26.3254	27.3378	28.5008	29.4504	(42b)
Hot water usage for other uses													
	41.6333	40.1193	38.6054	37.0914	35.5775	34.0636	34.0636	35.5775	37.0914	38.6054	40.1193	41.6333	(42c)
Average daily hot water use (litres/day)												151.9950	(43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	165.2746	161.9078	157.7154	151.1196	145.8430	140.1385	137.7833	141.9558	146.3795	152.3894	159.0934	164.8142	(44)
Energy conte	261.7546	230.5546	242.4027	206.8752	196.3328	172.3166	166.6369	175.7709	180.5006	206.7910	226.6577	258.0592	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	39.2632	34.5832	36.3604	31.0313	29.4499	25.8475	24.9955	26.3656	27.0751	31.0186	33.9986	38.7089	(46)

Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0206 (55)
Total storage loss													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)

If cylinder contains dedicated solar storage													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	316.6556	280.1426	297.3037	260.0052	251.2338	225.4466	221.5379	230.6719	233.6306	261.6920	279.7877	312.9602	(62)
WWHRS	-51.6701	-45.6974	-47.8517	-39.6231	-36.9273	-31.5990	-29.6190	-31.4968	-32.6935	-38.5421	-43.6635	-50.7132	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	264.9855	234.4451	249.4519	220.3820	214.3064	193.8476	191.9189	199.1751	200.9370	223.1499	236.1242	262.2470	(64)
Total per year (kWh/year) = Sum(64)m =												2690.9709	(64)
												2691	(64)

12Total per year (kWh/year)													
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	130.9542	116.3298	124.5197	111.2900	109.2014	99.7993	99.3276	102.3646	102.5204	112.6788	117.8677	129.7255	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	121.3441	134.3453	121.3441	125.3889	121.3441	125.3889	121.3441	121.3441	125.3889	121.3441	125.3889	121.3441	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	240.5783	243.0747	236.7837	223.3910	206.4851	190.5959	179.9809	177.4845	183.7755	197.1682	214.0741	229.9633	(68)
Pumps, fans	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	(71)
Total internal gains	176.0137	173.1098	167.3652	154.5694	146.7761	138.6101	133.5048	137.5869	142.3895	151.4500	163.7051	174.3622	(72)
	600.4878	613.0815	588.0447	565.9010	537.1570	517.1466	497.3815	498.9671	514.1055	532.5140	565.7198	588.2213	(73)

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6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			10.5300	10.6334	0.6300	0.7000	0.7700	34.2194 (74)				
South			4.2900	46.7521	0.6300	0.7000	0.7700	61.2957 (78)				
West			8.5800	19.6403	0.6300	0.7000	0.7700	51.4999 (80)				
Solar gains	147.0150	266.5262	404.9089	564.9897	687.5953	705.9071	670.9391	576.4412	460.1477	305.6626	179.0846	123.8431 (83)
Total gains	747.5027	879.6077	992.9536	1130.8907	1224.7523	1223.0537	1168.3207	1075.4084	974.2532	838.1766	744.8044	712.0644 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500	33.2500
alpha	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167	3.2167
util living area	0.9690	0.9481	0.9112	0.8307	0.7030	0.5428	0.4108	0.4595	0.6737	0.8736	0.9506	0.9732 (86)
Living	19.4255	19.6503	19.9692	20.3572	20.6596	20.8261	20.8803	20.8696	20.7449	20.3390	19.8064	19.3715
Non living	18.8876	19.1096	19.4229	19.7976	20.0794	20.2245	20.2663	20.2593	20.1598	19.7863	19.2660	18.8342
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1946	19.6503	19.9692	20.3572	20.6596	20.8261	20.8803	20.8696	20.7449	20.3390	19.8064	19.5993 (87)
Th 2	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757	20.3757 (88)
util rest of house	0.9657	0.9428	0.9020	0.8134	0.6737	0.4996	0.3571	0.4040	0.6328	0.8567	0.9446	0.9703 (89)
MIT 2	19.6145	19.1096	19.4229	19.7976	20.0794	20.2245	20.2663	20.2593	20.1598	19.7863	19.2660	19.0498 (90)
Living area fraction	19.8005	19.2829	19.5981	19.9770	20.2655	20.4174	20.4632	20.4550	20.3474	19.9635	19.4393	19.2260 (91)
MIT	19.8005	19.2829	19.5981	19.9770	20.2655	20.4174	20.4632	20.4550	20.3474	19.9635	19.4393	19.2260 (92)
Temperature adjustment												0.0000
adjusted MIT	19.8005	19.2829	19.5981	19.9770	20.2655	20.4174	20.4632	20.4550	20.3474	19.9635	19.4393	19.2260 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9622	0.9317	0.8889	0.8012	0.6683	0.5025	0.3648	0.4112	0.6308	0.8440	0.9338	0.9639 (94)
Useful gains	719.2830	819.5629	882.6412	906.1207	818.4712	614.6435	426.2239	442.2323	614.5962	707.4618	695.5288	686.3776 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1757.7572	1631.0305	1485.3286	1256.1413	971.3260	659.6935	438.0856	459.8406	708.4537	1061.8228	1399.2818	1703.9539 (97)
Space heating kWh	772.6249	545.3062	448.3994	252.0148	113.7240	0.0000	0.0000	0.0000	0.0000	263.6446	506.7021	757.0768 (98a)
Space heating requirement - total per year (kWh/year)												3659.4927
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	772.6249	545.3062	448.3994	252.0148	113.7240	0.0000	0.0000	0.0000	0.0000	263.6446	506.7021	757.0768 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3659.4927
Space heating per m2										(98c) / (4) =		40.2939 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												285.6285 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	772.6249	545.3062	448.3994	252.0148	113.7240	0.0000	0.0000	0.0000	0.0000	263.6446	506.7021	757.0768 (98)
Space heating efficiency (main heating system 1)	285.6285	285.6285	285.6285	285.6285	285.6285	0.0000	0.0000	0.0000	0.0000	285.6285	285.6285	285.6285 (210)
Space heating fuel (main heating system)	270.4999	190.9145	156.9869	88.2317	39.8153	0.0000	0.0000	0.0000	0.0000	92.3033	177.3990	265.0564 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

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Water heating requirement	264.9855	234.4451	249.4519	220.3820	214.3064	193.8476	191.9189	199.1751	200.9370	223.1499	236.1242	262.2470 (64)
Efficiency of water heater (217)m	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383	187.0383 (216)
Fuel for water heating, kWh/month	141.6745	125.3461	133.3695	117.8272	114.5789	103.6406	102.6094	106.4889	107.4310	119.3071	126.2438	140.2104 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	2.1644	1.9549	2.1644	2.0946	2.1644	2.0946	2.1644	2.1644	2.0946	2.1644	2.0946	2.1644 (231)
Lighting	27.7492	22.2615	20.0440	14.6851	11.3432	9.2675	10.3476	13.4502	17.4705	22.9223	25.8907	28.5205 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-15.8617	-27.4096	-48.7577	-64.8484	-76.5367	-72.0783	-70.6434	-62.4569	-48.8234	-34.3700	-18.7360	-12.9983 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	-2.7085	-7.4269	-19.8093	-38.8316	-60.5974	-66.1617	-64.3480	-49.6788	-30.6646	-12.7699	-4.0736	-2.0007 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1281.2070 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												187.0383
Water heating fuel used												1438.7275 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 2.6680, total flow = 29.0000, SFP = 0.0920)												
mechanical ventilation fans (SFP = 0.0920)												25.4841 (230a)
Total electricity for the above, kWh/year												25.4841 (231)
Electricity for lighting (calculated in Appendix L)												223.9523 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-912.5914 (233)
Wind generation												0.0000 (234)
Hydro-electric generation (Appendix N)												0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)												0.0000 (235)
Appendix Q - special features												
Energy saved or generated												-0.0000 (236)
Energy used												0.0000 (237)
Total delivered energy for all uses												2056.7795 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1281.2070	0.1554	199.0742 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1438.7275	0.1408	202.5303 (264)
Space and water heating			401.6045 (265)
Pumps, fans and electric keep-hot	25.4841	0.1387	3.5350 (267)
Energy for lighting	223.9523	0.1443	32.3232 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-553.5203	0.1317	-72.8717
PV Unit electricity exported	-359.0710	0.1196	-42.9381
Total			-115.8098 (269)
Total CO2, kg/year			321.6529 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.5400 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1281.2070	1.5752	2018.1853 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1438.7275	1.5205	2187.6017 (278)
Space and water heating			4205.7870 (279)
Pumps, fans and electric keep-hot	25.4841	1.5128	38.5523 (281)
Energy for lighting	223.9523	1.5338	343.5055 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-553.5203	1.4864	-822.7552
PV Unit electricity exported	-359.0710	0.4386	-157.4815
Total			-980.2367 (283)
Total Primary energy kWh/year			3607.6080 (286)
Dwelling Primary energy Rate (DPER)			39.7200 (287)

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SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.8200 (1b)	x 2.5000 (2b)	= 227.0500 (1b) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.8200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 227.0500 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) = 0.1321 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3821 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3535 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4507	0.4418	0.4330	0.3888	0.3800	0.3358	0.3358	0.3270	0.3535	0.3800	0.3977	0.4153 (22b)
Effective ac	0.6016	0.5976	0.5937	0.5756	0.5722	0.5564	0.5564	0.5535	0.5625	0.5722	0.5791	0.5862 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type (Uw = 1.20)			20.8200	1.1450	23.8397		(27)
Heat Loss Floor 1			90.8200	0.1300	11.8066		(28a)
External Wall 1	86.2950	20.8200	65.4750	0.1800	11.7855		(29a)
Corridor wall	42.3800	1.8900	40.4900	0.1800	7.2882		(29a)
Bike area wall	30.1000		30.1000	0.1800	5.4180		(29a)
Total net area of external elements Aum(A, m ²)			249.5950				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	62.0280		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 159.4607 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	27.6000	0.0500	1.3800
E5 Ground floor (normal)	63.5100	0.1600	10.1616
E16 Corner (normal)	10.0000	0.0900	0.9000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.6866 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	75.7146 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	45.0723	44.7768	44.4872	43.1269	42.8724	41.6876	41.6876	41.4682	42.1439	42.8724	43.3873	43.9255 (38)
Heat transfer coeff	120.7869	120.4914	120.2018	118.8415	118.5870	117.4022	117.4022	117.1828	117.8585	118.5870	119.1018	119.6401 (39)
Average = Sum(39)m / 12 =												118.8403

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3300	1.3267	1.3235	1.3085	1.3057	1.2927	1.2927	1.2903	1.2977	1.3057	1.3114	1.3173 (40)

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HLP (average)												1.3085
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												2.6368 (42)
Hot water usage for mixer showers												
68.4299	67.4015	65.9030	63.0358	60.9199	58.5603	57.2190	58.7062	60.3365	62.8700	65.7988	68.1677	(42a)
Hot water usage for baths												
29.5503	29.1114	28.4934	27.3539	26.5007	25.5546	25.0435	25.6572	26.3254	27.3378	28.5008	29.4504	(42b)
Hot water usage for other uses												
41.6333	40.1193	38.6054	37.0914	35.5775	34.0636	34.0636	35.5775	37.0914	38.6054	40.1193	41.6333	(42c)
Average daily hot water use (litres/day)												128.3362 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
139.6134	136.6323	133.0018	127.4812	122.9981	118.1784	116.3261	119.9409	123.7533	128.8132	134.4188	139.2513	(44)
Energy content	221.1135	194.5625	204.4188	174.5153	165.5791	145.3141	140.6864	148.5119	152.6002	174.7982	191.5043	218.0340 (45)
Energy content (annual)										Total =	Sum(45)m =	2131.6383
Distribution loss (46)m = 0.15 x (45)m												
33.1670	29.1844	30.6628	26.1773	24.8369	21.7971	21.1030	22.2768	22.8900	26.2197	28.7256	32.7051	(46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage												
23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
267.7084	236.6482	251.0137	219.6072	212.1740	190.4060	187.2813	195.1069	197.6921	221.3931	236.5961	264.6289	(62)
WWHRS	-31.2833	-27.6672	-28.9715	-23.9895	-22.3574	-19.1314	-17.9326	-19.0695	-19.7941	-23.3350	-26.4357	-30.7040 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	236.4252	208.9810	222.0422	195.6176	189.8166	171.2746	169.3487	176.0373	177.8980	198.0581	210.1604	233.9249 (64)
								Total per year (kWh/year) =	Sum(64)m =			2389.5846 (64)
12Total per year (kWh/year)												2390 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) =	Sum(64a)m =			0.0000 (64a)
Heat gains from water heating, kWh/month												
110.7962	98.3606	105.2452	94.0998	92.3310	84.3904	84.0541	86.6561	86.8130	95.3963	99.7486	109.7722	(65)

5. Internal gains (see Table 5 and 5a)												

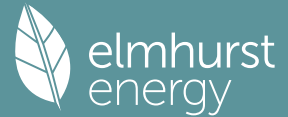
Metabolic gains (Table 5), Watts												
(66)m	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389	131.8389 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
121.3441	134.3453	121.3441	125.3889	121.3441	125.3889	121.3441	121.3441	125.3889	121.3441	125.3889	121.3441	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
240.5783	243.0747	236.7837	223.3910	206.4851	190.5959	179.9809	177.4845	183.7755	197.1682	214.0741	229.9633	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	36.1839	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	-105.4711	(71)
Water heating gains (Table 5)												
148.9196	146.3700	141.4586	130.6942	124.1007	117.2089	112.9760	116.4733	120.5737	128.2209	138.5398	147.5433	(72)
Total internal gains	576.3936	589.3416	565.1381	545.0258	517.4816	495.7454	476.8527	477.8536	492.2897	512.2849	543.5545	564.4024 (73)

6. Solar gains												

[Jan]												
			Area	Solar flux				g	FF		Access	Gains
			m2	Table 6a				Specific data	Specific data		factor	W
				W/m2				or Table 6b	or Table 6c		Table 6d	
North			9.3600	10.6334			0.6300		0.7000		0.7700	30.4172 (74)
South			3.8200	46.7521			0.6300		0.7000		0.7700	54.5803 (78)
West			7.6400	19.6403			0.6300		0.7000		0.7700	45.8577 (80)

Solar gains	130.8553	237.2248	360.3756	502.8137	611.8907	628.1700	597.0595	512.9917	409.5276	272.0541	159.3990	110.2309 (83)
Total gains	707.2489	826.5664	925.5136	1047.8395	1129.3723	1123.9153	1073.9123	990.8453	901.8173	784.3390	702.9535	674.6332 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.3053	33.3869	33.4674	33.8505	33.9231	34.2655	34.2655	34.3296	34.1328	33.9231	33.7765	33.6245
alpha	3.2204	3.2258	3.2312	3.2567	3.2615	3.2844	3.2844	3.2886	3.2755	3.2615	3.2518	3.2416
util living area	0.9775	0.9624	0.9349	0.8692	0.7562	0.5967	0.4574	0.5079	0.7251	0.9027	0.9635	0.9805 (86)
MIT	18.9037	19.1890	19.6100	20.1620	20.6042	20.8711	20.9596	20.9428	20.7460	20.1645	19.4463	18.8612 (87)
Th 2	19.8174	19.8200	19.8225	19.8342	19.8363	19.8466	19.8466	19.8485	19.8426	19.8363	19.8319	19.8273 (88)
util rest of house	0.9726	0.9542	0.9204	0.8399	0.7020	0.5109	0.3472	0.3949	0.6470	0.8741	0.9542	0.9762 (89)
MIT 2	17.4102	17.7711	18.2993	18.9787	19.4851	19.7610	19.8296	19.8222	19.6518	19.0002	18.1084	17.3625 (90)
Living area fraction									fLA = Living area / (4) =			0.3206 (91)
MIT	17.8890	18.2257	18.7195	19.3582	19.8439	20.1169	20.1919	20.1815	20.0027	19.3735	18.5373	17.8430 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8890	18.2257	18.7195	19.3582	19.8439	20.1169	20.1919	20.1815	20.0027	19.3735	18.5373	17.8430 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9611	0.9394	0.9031	0.8257	0.7024	0.5322	0.3814	0.4291	0.6590	0.8601	0.9401	0.9657 (94)
Useful gains	679.7122	776.4399	835.8351	865.2266	793.2230	598.1193	409.5899	425.1908	594.2896	674.6019	660.8482	651.5151 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1641.3765	1605.6365	1468.8106	1242.8625	965.7632	647.7002	421.6977	443.1288	695.6786	1040.4199	1362.2093	1632.2541 (97)
Space heating kWh	715.4782	557.2201	470.9338	271.8979	128.3699	0.0000	0.0000	0.0000	0.0000	272.1686	504.9800	729.6699 (98a)
Space heating requirement - total per year (kWh/year)												3650.7183
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh	715.4782	557.2201	470.9338	271.8979	128.3699	0.0000	0.0000	0.0000	0.0000	272.1686	504.9800	729.6699 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3650.7183
Space heating per m2										(98c) / (4) =		40.1973 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	715.4782	557.2201	470.9338	271.8979	128.3699	0.0000	0.0000	0.0000	0.0000	272.1686	504.9800	729.6699 (98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000 (210)
Space heating fuel (main heating system)	775.1660	603.7054	510.2208	294.5806	139.0790	0.0000	0.0000	0.0000	0.0000	294.8738	547.1073	790.5416 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	236.4252	208.9810	222.0422	195.6176	189.8166	171.2746	169.3487	176.0373	177.8980	198.0581	210.1604	233.9249 (64)
Efficiency of water heater	86.3803	86.1499	85.7029	84.7984	83.2021	79.8000	79.8000	79.8000	79.8000	84.7730	85.9513	79.8000 (216)
Fuel for water heating, kWh/month	273.7025	242.5783	259.0836	230.6857	228.1392	214.6298	212.2164	220.5981	222.9298	233.6335	244.5111	270.6414 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)
Lighting	25.2129	20.2267	18.2119	13.3428	10.3064	8.4204	9.4018	12.2209	15.8737	20.8271	23.5242	25.9137 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-24.0405	-35.4610	-53.2988	-62.7442	-70.1088	-66.3163	-65.4862	-60.5956	-52.4127	-41.7636	-26.9743	-20.6041 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-9.2041	-19.7359	-39.9368	-61.0441	-81.7728	-82.5679	-81.6170	-68.6363	-49.6822	-28.5918	-12.4042	-7.2522 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

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Annual totals kWh/year		
Space heating fuel - main system 1	3955.2744	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2853.3495	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	203.4826	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1122.2515	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	5975.8550	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3955.2744	0.2100	830.6076 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2853.3495	0.2100	599.2034 (264)
Space and water heating			1429.8110 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	203.4826	0.1443	29.3688 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-579.8062	0.1337	-77.4933
PV Unit electricity exported	-542.4453	0.1254	-68.0110
Total			-145.5043 (269)
Total CO2, kg/year			1325.6048 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.6000 (273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3955.2744	1.1300	4469.4601 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2853.3495	1.1300	3224.2850 (278)
Space and water heating			7693.7450 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	203.4826	1.5338	312.1084 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-579.8062	1.4939	-866.1777
PV Unit electricity exported	-542.4453	0.4602	-249.6336
Total			-1115.8112 (283)
Total Primary energy kWh/year			7020.1430 (286)
Target Primary Energy Rate (TPER)			77.3000 (287)